School of Chemical Engineering

UNSW Engineering

CEIC4007

Product Design Project Thesis A

Term 1, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Patrick Spicer	p.spicer@unsw.edu.au		318 Hilmer	

School Contact Information

For assistance with enrolment, class registration, progression checks and other administrative matters, please see the Nucleus: Student Hub. They are located inside the Library – first right as you enter the main library entrance. You can also contact them via http://unsw.to/webforms or reserve a place in the face-to-face queue using the UniVerse app.

If circumstances outside your control impact on submitting assessments, Special Consideration may be granted, usually in the form of an extension or a supplementary assessment. Applications for Special Consideration must be submitted online.

For course administration matters, please contact the Course Coordinator.

Questions about the this course should normally be asked during the scheduled class so that everyone can benefit from the answer and discussion.

Course Details

Units of Credit 6

Summary of the Course

Design and creative development is the engine of growth for economies and industry product portfolios. Chemical products touch consumers the world over, delivering innovations in pharmaceuticals, advanced materials, cosmetics, and foods. This course will enable students to explore global corporate innovations through case studies and active working groups, map consumer and market needs, and develop an intellectual property strategy as well as a working product prototype. Industry partners will work with students to explore, create, and assess their products as they go. Whether interested in developing new innovations for existing companies or for their own entrepreneurial efforts, students will gain confidence and independence that will make real contributions to the global economy.

In CEIC4007 students will identify product needs and map opportunities for a commercial chemical product development effort. The outcome of the course will be a novel product intellectual property and a clear plan to develop a working product prototype in the next course, CEIC4008.

Course Aims

The Product Design Thesis requires students to apply knowledge from previous course to research, design, and plan a chemical product commercialisation strategy. Designing and delivering new products to market is a complex process. Open-ended problems must be solved, requiring creativity, study, and quantitative analysis of results. Multiple correct approaches can exist for these problems, and student innovation and creativity will be rewarded.

The Product Design Thesis poses these problems in the context of chemical or food product development, so the challenges draw on the food science and chemical engineering curriculum as well as a student's initiative, innovation, and entrepreneurship. Students will work through the design process, define consumer and product requirements, and pose the needs as an engineering problem. Students will collaborate with each other, map competitive and supportive literature and patents, and work constructively with others in a research and development environment.

Students will be able to:

- Apply engineering and general design principles to product design through case studies and self-directed identification and study of examples.
- Practice consumer and market research using publicly available and intellectual property documentation.
- Define consumer need and link technological barriers and enablers to the need.
- Develop a product intellectual property strategy.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Develop a product design following industry and professional engineering standards.	PE2.2, PE2.3, PE2.4
2. Critically reflect on a specialist body of knowledge, literature, patent, and others, related to their design goal.	PE1.3
3. Apply scientific and engineering methods to solve a practical commercial design problem.	PE2.1
4. Analyse past and preliminary data objectively using quantitative and mathematical methods.	PE1.2, PE2.1, PE2.2
5. Demonstrate oral and written communication in professional and lay domains.	PE3.2

Professional Recognition of Course

This course is part of UNSW Food Science specialisations approved (2021-2026) by the Institute of Food Technologists Higher Education Review Board (IFT HERB).

Teaching Strategies

Like other undergraduate thesis projects, the pair CEIC4007+CEIC4008 is designed to be a capstone experience. There is considerable scope for enquiry-based learning and students are expected to make use of the literature to help design and deliver a project over two terms. These courses will:

- Use real-world examples of failed and successful product designs, and their history, to motivate students to search and map additional product examples based on their own interests, social causes, or career goals.
- Connect working product designers and developers, as well as consumers of products, to students in order to motivate their own exploration and design concept development.
- Use in-class examples and outside class exercises to provide students with hands-on practice and self-directed exploration of new products, technologies, and market needs.

The Product Design Thesis (CEIC4007+CEIC4008) is designed to be a Thesis project course within the Faculty of Engineering’s Thesis rules and procedures.

Course aims

The Product Design Thesis requires students to bring together their knowledge from previous years of study to research, design and plan a commercialisation strategy for a chemical product. Designing and delivering a new product to market is a complex process in which open-ended problems must be addressed, requiring creativity and the acquisition, analysis and interpretation of results. There are multiple correct approaches to the problem and the creativity of the students is rewarded. The Product Design Thesis poses these problems through the lens of the development of a chemical product, and

challenges cover the technical chemical engineering curriculum as well as innovation and entrepreneurship. Students will work through the design process, undertaking a requirements analysis and then working out how to reframe that in engineering terms. Students will collaborate with each other, look for literature support for their plans and to learn to work in a research and development environment.

Course Learning Outcomes

The Product Design Thesis CLOs are copied from the Thesis guide with editorial changes to be specific to the product design process.

Assessment Procedure

The weightings and activities recommended in the thesis guide are implemented within CEIC4007/4008. For the purposes of delivery within the entrepreneurship model adopted for these courses, the elements of the assessment items are regrouped as shown in the course outline; the relative weightings that are achieved are shown below.

CEIC4007 Chemical Product Design Thesis A

Mapping of CEIC4007 assessment items to Faculty of Engineering Thesis Marking Criteria. Percentages are total course marks. Decimals are the relative weighting within a row. Marking rubrics for individual assessment items in A-D will be weighted to achieve the allocation of marks required

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Presentations in biweekly tutor meetings with group	10%	Not Applicable	1, 3, 4, 5
2. Preliminary concept interview	20%	Week 7	1, 2, 5
3. Final product concept presentation	20%	Week 10	3, 5
4. Final provisional patent and documentation of product	50%	Stuvac	1, 2, 3, 4, 5

Assessment 1: Presentations in biweekly tutor meetings with group

Start date: 15/02/2023 04:00 PM

Structured communication of progress, proposed direction, and needs. This will be marked as a group but will be the result of individual contributions and collaborative efforts. Initially these presentations will focus on case study, literature, and patent review, highlighting approaches and methods the students discover during their critical readings. As the project definition phase coalesces, a specific product concept will be developed and various aspects of that will be the focus of these discussions.

Assessment 2: Preliminary concept interview

Due date: Week 7

Discussion of initial product justification to instructor, tutors, and industry partners. Once a product goal has been identified, discussions by the responsible individuals will focus on justification of the financial, competitive, innovative, and feasibility aspects of the goal. Feedback will be given to shape the project and ensure it is an appropriate scope for the time available and that the student assessments are accurate.

Assessment 3: Final product concept presentation

Due date: Week 10

Initial, and then more developed, scope of product plan to instructor, tutors, and industry partners. With a product goal in mind, the students must identify the key roles needed for the project team in order to carry out the work successfully. These roles will be assumed and the responsibilities, the success criteria for the roles, and the plan for interaction and project execution will be mapped and communicated individually by the responsible person.

Assessment 4: Final provisional patent and documentation of product

Due date: Stuvac

Written summary of product intellectual property strategy with key recommendations. This document parallels the literature review submitted for traditional Thesis projects but will actually take the form of a detailed invention and patent disclosure. Several sections are needed for such a document and can have multiple forms and variations, but will allow individual work on each to be carried out:

- The work will be motivated and applications will be discussed.
- Past work and prior art will be reviewed and gaps or whitespace highlighted.
- Novelty and non-obviousness will be explained (though no legal judgements will be made or inferred).
- Conceptual examples of the new development and concept will be presented along with a plan for the second phase of the thesis to product a product prototype.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 13 February - 17 February	Lecture	Intro/Product Design and Development
Week 2: 20 February - 24 February	Lecture	How to define and utilise market needs?
Week 3: 27 February - 3 March	Lecture	What is innovation? How do we develop ideas?
Week 4: 6 March - 10 March	Lecture	Ideas and selection of ideas
Week 5: 13 March - 17 March	Lecture	Intellectual property, Patents
Week 6: 20 March - 24 March	Project	Flexibility week (use to work on project and background innovation)
Week 7: 27 March - 31 March	Lecture	**Preliminary presentations**
	Assessment	Preliminary concept interview
Week 8: 3 April - 7 April	Lecture	IP strategy construction
Week 9: 10 April - 14 April	Lecture	The competition: how do we find 'white space' for innovation and opportunity?
Week 10: 17 April - 21 April	Project	**Final concept presentation/Q&A**
	Assessment	Final product concept presentation
Stuvac: 22 April - 27 April	Assessment	Final provisional patent and documentation of product

Resources

Prescribed Resources

Some course materials, and most assessment tasks are delivered through Moodle and students should check regularly for updates and pre-reading assignments.

Recommended Resources

There are many books on the topics relevant to this course but no single textbook covers the whole spectrum. Literature and textbook references will be regularly assigned as pre-reading for lectures. Students will also be required to find information to augment lectures and help with their product development projects.

1. Bröckel, Ulrich, Willi Meier, and Gerhard Wagner, eds. *Product design and engineering: formulation of gels and pastes*. John Wiley & Sons, 2013.
2. Norton and Fryer, *Formulation Engineering of Foods*, Wiley, 2013.
3. Traitler, H., Coleman, B., & Burbidge, A. *Food Industry R&D: A New Approach*, Wiley, 2016.
4. Cussler and Moggridge, Chemical Product Design, Cambridge, 2011.
5. Sensory and Consumer Research in Food Product Design and Development, Howard R. Moskowitz and Jacqueline H. Beckley, 2012
6. New food product development: from concept to marketplace, G.W. Fuller, Boca Raton: CRC Press, 2011.
7. Developing new food products for a changing marketplace, ed. A.L. Brody and J.B. Lord, Lancaster: Technomic, 2000.

Course Evaluation and Development

This course is highly interactive and constant feedback is solicited and discussed. As we document new insights these changes will be highlighted on our Teams site.

Laboratory Workshop Information

This course works through lectures and workshops. The latter will involve frequent discussion and idea development workshops but no laboratories.

Submission of Assessment Tasks

In the School of Chemical Engineering, all written work will be submitted for assessment via Moodle unless otherwise specified. Attaching cover sheets to uploaded work is not required unless specifically requested for an individual assessment task; when you submit work through Moodle for assessment you are agreeing to uphold the Student Code.

Some assessments will require you to complete the work online and it may be difficult for the course coordinator to intervene in the system after the due date. You should ensure that you are familiar with assessment systems well before the due date. If you do this, you will have time to get assistance before the assessment closes.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect. Please make it easy for the markers who are looking at your work to see your achievement and give you due credit.

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Late penalties

Unless otherwise specified, submissions received after the due date and time will be penalised at a rate of 5% per day or part thereof (including weekends) and will not be accepted more than 5 days late. For some activities including Exams, Quizzes, Peer Feedback, and Team Evaluation surveys, extensions and late submissions are not possible.

Special consideration

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

UNSW has a Fit to Sit / Submit rule, which means that if you attempt an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

Please note that for **all** special consideration requests (including COVID-19-related requests), students will need documentary evidence to support absences from any classes or assessments.

Academic Honesty and Plagiarism

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage (International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013). At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and plagiarism can be located at:

- The Current Students site
- The ELISE training site

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

To help describe what we are looking for, here are some things that we consider to be quite acceptable (even desirable!) actions for many assessments, and some that we consider to be unacceptable in most circumstances. Please check with the instructions for your assessments and your course coordinator if you're unsure. As a rule of thumb, if you don't think you could look the lecturer in the eye and say "this is my own work", then it's not acceptable.

Acceptable actions	Unacceptable actions
✓ reading/searching through material we have given you, including lecture slides, course notes, sample problems, workshop problem solutions	✗ asking for help with an assessment from other students, friends, family
✓ reading/searching lecture transcripts	✗ asking for help on Q&A or homework help websites
✓ reading/searching resources that we have pointed you to as part of this course, including textbooks, journal articles, websites	✗ searching for answers to the specific assessment questions online or in shared documents
✓ reading/searching through your own notes for this course	✗ copying material from any source into your answers
✓ all of the above, for any previous courses	✗ using generative AI tools to complete or substantially complete an assessment for you
✓ using spell checkers, grammar checkers etc to improve the quality of your writing	✗ paying someone else to do the assessment for you
✓ studying course material with other students	

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism. Further information about referencing styles can be located at https://student.unsw.edu.au/referencing.

For assessments in the School of Chemical Engineering, we recommend the use of referencing software such as Mendeley or EndNote for managing references and citations. Unless required otherwise

specified (i.e. in the assignment instructions) students in the School of Chemical Engineering should use either the APA 7th edition, or the American Chemical Society (ACS) referencing style as canonical author-date and numbered styles respectively.

Artificial intelligence tools such as ChatGPT, CodePilot, and built-in tools within Word are modern tools that are useful in some circumstances. In your degree at UNSW, we're teaching you skills that are needed for your professional life, which will include how to use AI tools responsibly plus lots of things that AI tools cannot do for you. AI tools already are (or will soon be) part of professional practice for all of us. However, if we were only teaching you things that AI could do, your degree would be worthless, and you wouldn't have a job in 5 years.

Whether the use of AI tools in an assessment is appropriate will depend on the goals of that assessment. As ever, you should discuss this with your lecturers – there will certainly be assessments where the use of AI tools is encouraged, as well as others where it would interfere with your learning and place you at a disadvantage later. Our goal is to help you learn how to ethically and professionally use the tools available to you. To learn more about the use of AI, see this discussion we have written where we analyse the strengths and weaknesses of generative AI tools and discuss when it is professionally and ethically appropriate to use them.

While AI may might provide useful tools to help with some assessments, UNSW's policy is quite clear that taking the output of generative AI and submitting it as your own work will never be appropriate, just as paying someone else to complete an assessment for you is serious misconduct.

Academic Information

To help you plan your degree, assistance is available from academic advisors in The Nucleus and also in the School of Chemical Engineering.

Additional support for students

- Current Student Gateway for information about key dates, access to services, and lots more information
- Engineering Student Life - Current Student Resources for information about everything from getting to campus to our first year guide
- Student Support and Success for our UNSW team dedicated to helping with university life, visas, wellbeing, and academic performance
- Academic Skills to brush up on some study skills, time management skills, get one-on-one support in developing good learning habits, or join workshops on skills development
- Student Wellbeing, Health and Safety for information on the UNSW health services, mental health support, and lots of other useful wellbeing resources
- Equitable Learning Services for assistance with long term conditions that impact on your studies
- IT Service Centre for everything to do with computing, including installing UNSW licensed software, access to computing systems, on-campus WIFI and off-campus VPNs

Course workload

Course workload is calculated using the Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete, for both regular and intensive terms. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations. Most 6 UoC courses will involve approximately 10-12 hours per week of work on your part. If you're not sure what to do in these hours of independent study, the resources on the UNSW Academic Skills pages offer some suggestions including: making summaries of lectures, read/summarise sections from the textbook, attempt workshop problems, reattempting workshop problems with some hints from the solutions, looking for additional problems in the textbook.

Full-time enrolment at university means that it is a *full-time* occupation for you and so you would typically need to devote 35 hours per week to your studies to suceed. Full-time enrolment at university is definitely incompatible with full-time employment. Part-time/casual employment can certainly fit into your study schedule but you will have to carefully balance your study obligations with that work and decide how much time for leisure, family, and sleep you want left after fullfilling your commitments to study and work. Everyone only gets 168 hours per week; overloading yourself with both study commitments and work commitments leads to poor outcomes and dissatisfaction with both, overtiredness, mental health issues, and general poor quality of life.

On-campus class attendance

In 2023, most classes at UNSW are running in a face-to-face mode only. Attendance is expected as is

participation in the classes. As an evidence-driven engineer or scientist, you'll be interested to know that education research has shown students learn more effectively when they come to class, and less effectively from lecture catch-up recordings. If you have to miss a class due to illness, for example, we expect you to catch up in your time, and within the coming couple of days.

For most courses that are running in an "in person" mode:

- Lectures are normally recorded to provide an opportunity to review material after the lecture; lecture recordings are not a substitute for attending and engaging with the live class.
- Workshops/tutorials are not normally recorded as the activities that are run within those sessions normally cannot be captured by a recording. These activities may also include assessable activities in some or all weeks of the term.
- Laboratories are not recorded and require in-person attendance. Missing laboratory sessions may require you to do a make-up session later in the term; if you miss too many laboratory sessions, it may be necessary to seek a Permitted Withdrawal from the course and reattempt it next year, or end up with an Unsatisfactory Fail for the course.
- Assessments will often require in-person attendance in a timetabled class or a scheduled examination.

This course outline will have further details in the Course Schedule and Assessment sections.

Class numbers are capped in each class to ensure appropriate facilities are available, to maintain student:staff ratios, and to help maintain adequate ventilation in the spaces. Only students enrolled in each specific classes will be allowed in the room. Class rosters will be attached to corresponding rooms and circulated among lab demonstrators and tutors. No over-enrolment is allowed in face-to-face classes.

In certain classroom and laboratory situations where physical distancing cannot be maintained or the staff running the session believe that it will not be maintained, face masks will be designated by the course coordinator as **mandatory PPE** for students and staff. Students are required to bring and use their own face mask. Mask can be purchased from IGA Supermarket (Map B8, Lower Campus), campus pharmacy (Map F14, Middle Campus), the post office (Map F22, Upper Campus) and a vending machine in the foyer of the Biological Sciences Building (Map E26, Upper Campus).

Your health and the health of those in your class is critically important. You must stay at home if you have COVID-19 or have been advised to self-isolate by NSW health or government authorities.

Asking Questions

Asking questions is an important part of learning. Learning to ask good questions and building the confidence to do so in front of others is an important professional skill that you need to develop. The best place to ask questions is during the scheduled classes for this course, with the obvious exception being questions that are private in nature such as special consideration or equitable learning plans. Between classes, you might also think of questions — some of those you might save up for the next class (write them down!), and some of them you might ask in a Q&A channel on Teams or a Q&A forum on Moodle. Please understand that staff won't be able to answer questions on Teams/Moodle immediately but will endeavour to do so during their regular working hours (i.e. probably not at midnight!) and when they are next working on this particular course (i.e. it might be a day or two). Please respect that staff are juggling multiple work responsibilities (teaching more than one course, supervising research students, doing experiments, writing grants, …) and also need to have balance between work and the rest of their life.

Note: This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Pilot Hall with experiment rigs // UNSW Chemical Engineering

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	✓
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	